

WHAT IS CLAIMED IS:

1. An induction heating system comprising:
a power switch;
a resonant heating circuit configured to generate an oscillating voltage in response to a DC voltage pulse input; and
a pulse initiator positioned across the power switch and configured to monitor a voltage across the power switch and to initiate application of a subsequent DC voltage pulse to the resonant heating circuit upon detecting a substantially zero voltage across the power switch during a first cycle of the oscillating voltage.
2. The induction heating system of claim 1, wherein the power switch is configured to close and open to provide the DC voltage pulses.
3. The induction heating system of claim 2, wherein the power switch is configured to open and close in response to a switch control signal.
4. The induction heating system of claim 3, further comprising:
a pulse controller positioned between the pulse initiator and the power switch and configured to provide the switch control signal to the power switch, wherein the switch control signal causes the power switch to close in response to the pulse initiator detecting a substantially zero voltage across the power switch during a first cycle of the oscillating voltage and to open after a duration to thereby apply the subsequent DC voltage pulse to the resonant heating circuit.
5. The induction heating system of claim 4, wherein the duration is fixed at a value substantially equal to a maximum allowable duration that is a predetermined value based on a maximum energy storage capacity of the resonant heating circuit.

6. The induction heating system of claim 1, wherein the pulse initiator comprises:
a voltage divider positioned across the power switch and configured to provide a
monitoring voltage representative of a voltage across the power switch; and
a level switch configured to receive the monitoring voltage and to initiate
application of the subsequent DC voltage pulses when a level of the
monitoring voltage is substantially equal to a predetermined positive
threshold level.
7. The induction heating system of claim 6, wherein the voltage divider comprises
a first resistor and a second resistor series connected across the voltage switch
wherein the monitoring voltage is a voltage across the second resistor; and
a plurality of diodes series connected anode to cathode across the second resistor
that functions to limit the voltage across the second resistor so as not to
damage the level switch.
8. The induction heating system of claim 7, wherein the diodes comprise high-speed
switching breakdown diodes having a low capacitance.
9. The induction heating system of claim 1, wherein the resonant heating circuit
comprises:
a resonant capacitor; and
an induction heating coil coupled in parallel with the resonant capacitor.
10. The induction heating system of claim 1, wherein the power switch comprises an
insulated gate bipolar transistor (IGBT) having a gate, a collector, and an emitter.
11. A method of operating an inductive heating system comprising:
operating a power switch to apply a DC voltage pulse across a resonant circuit;
generating with the resonant circuit an oscillating voltage in response to the DC
voltage pulse;

applying a subsequent DC voltage pulse to the resonant circuit upon detecting a substantially zero voltage across the power switch during a first cycle of the oscillating voltage.

12. The method of claim 11, wherein operating the power switch comprises:
closing and opening the power switch.
13. The method of claim 11, wherein detecting the substantially zero voltage across the power switch comprises:
providing a monitoring voltage representative of a voltage across the power switch;
closing the power switch when the monitoring voltage is substantially equal to a predetermined threshold value.
14. An induction heating system connectable to an AC source, the system comprising:
a rectifier connectable to the AC source and configured to provide a DC voltage at a DC output node;
a power switch having a first terminal, a second terminal coupled to ground, and a control gate;
a resonant circuit coupled between the DC output node and the first terminal of the power switch;
a pulse controller configured to provide a control signal to the power switch control gate to close and open the switch to thereby provide a DC voltage pulse to the resonant circuit and causing the resonant circuit to generate an oscillating voltage; and
a pulse initiator coupled across the power switch terminals and configured to monitor an oscillating voltage across the power switch and to provide a control signal to the pulse controller instructing the pulse controller to close the power switch when the oscillating voltage across the power switch reaches a predetermined threshold value such that when the switch closes the voltage across the power switch is substantially equal to zero.

15. The induction heating system of claim 14, wherein the power switch comprises:
an IGBT having a gate configured to receive the control voltage, a collector
coupled to the resonant circuit, and an emitter coupled to ground.
16. The induction heating system of claim 14, wherein the pulse initiator comprises:
a voltage divider circuit coupled across the power switch terminals and configured
to provide a monitoring voltage representative of oscillating voltage across
the power switch; and
a level switch configured to receive the monitoring voltage and to provide the
control signal to the pulse controller when a level of the monitoring voltage
is substantially equal to the predetermined threshold value.
17. The induction heating system of claim 16, wherein the voltage divider comprises:
a monitoring node coupled to the level switch;
a first resistor coupled between the first terminal of the power switch and the
monitoring node;
a second resistor coupled between the monitoring node and ground, wherein a
voltage across the second resistor is the monitoring voltage; and
a plurality of diodes connected in series with an anode of the first series connected
diode coupled to the monitoring node and a cathode of the last series
connected diode coupled to ground, wherein the diodes limit the voltage
across the second resistor.
18. The induction heating system of claim 17, wherein the diodes comprise high-speed
switching breakdown diodes having a low capacitance.
19. The induction heating system of claim 16, wherein the level switch comprises:
an inverting CMOS Schmitt Trigger with hysteresis and having a low threshold
voltage substantially equal to the predetermined threshold value and a high
threshold value.

20. The induction heating system of claim 14, wherein the resonant circuit comprises:
a parallel resonant circuit comprising:
a capacitor having a first terminal coupled to the DC output node and a
second terminal coupled to the first terminal of the power switch;
and
an inductive heating coil coupled in parallel with the capacitor.
21. The induction heating system of claim 20, wherein the inductive heating coil is inductively coupleable to a working head.
22. The induction heating system of claim 14, wherein the pulse controller is further configured to configured to open the switch after a predetermined maximum duration wherein the maximum duration is based on a maximum energy storage capacity of the resonant heating circuit.
23. The induction heating system of claim 14, wherein the pulse controller is configured to close the power switch based on an initial power-up of the induction heating system and to thereafter close the switch based on the pulse initiator control signal.